ALCOHOL INTOXICATION ELIMINATES THE OWN-RACE BIAS

Now *everyone* looks the same: Alcohol intoxication reduces the own-race bias in face recognition

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Abstract

Several factors influence the reliability of eyewitness identification evidence. Typically, recognition for same-race faces is better than for different-race faces (the own-race bias), and alcohol intoxication decreases overall face recognition accuracy. The present research investigated how alcohol intoxication influences the own-race bias. Asian and European participants completed tests of recognition memory for Asian and European faces when either mildly intoxicated (mean breath alcohol concentration of .05) or when sober. Compared to their sober counterparts, intoxicated participants showed a reduced own-race bias. Specifically, alcohol intoxication had a larger negative effect on the recognition of same-race faces compared to different-race faces. The legal and theoretical implications of these results are discussed.

Keywords: own-race bias; alcohol intoxication; face recognition; eyewitness identification

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The own-race bias (also known as the cross-race effect) refers to the general tendency for people to show better recognition memory for faces from their own racial group (same-race faces) compared to faces from a different racial group (different-race faces; Meissner & Brigham, 2001). The own-race bias is a very robust effect, found across a variety of racial groups (Chance & Goldstein, 1996; Meissner & Brigham, 2001; Ng & Lindsay, 1994), age groups (e.g. Corenblum & Meissner, 2006; Pezdek, Blandon-Gitlin, & Moore, 2003), and recognition tasks (e.g. Lindsay, Jack, & Christian, 1991; Meissner & Brigham, 2001; Smith, Stinson, & Prosser, 2004; Walker & Tanaka, 2003).

The own-race bias is often an issue that is raised when considering the reliability of different-race eyewitness identification evidence presented in criminal prosecutions (see Wells & Olson, 2001). A survey of psychologists specialising in eyewitness evidence found that 90% believed the own-race bias was reliable enough to warrant being the subject of expert testimony in the courtroom (Kassin, Tubb, Hosch, & Memon, 2001). In the United States, a number of courts have allowed experts to describe research on the own-race bias (e.g. *United States v. Norwood*, 1996; *United States v. Smith,* 1984; *United States v. Stevens*, 1984; but not in *United States v. Hudson,* 1989 and *United States v. Watson,* 1978; see also Brigham, Wasserman, & Meissner, 1999; Leippe, 1995), and some courts allow a general warning about the lower accuracy of different-race identifications to be given (e.g., the New Jersey Supreme Court in *State v. Cromedy,* 1999, cited in Meissner & Brigham, 2001). Thus, the own-race bias is a widely recognised phenomenon within the legal system.

One area that has not been explored, however, is how the own-race bias might be influenced by other factors known to affect eyewitness identification accuracy, such as alcohol intoxication. Broadly speaking, alcohol intoxication has been shown to have a negative effect on people’s memory for information they are exposed to when intoxicated (see Mintzer, 2007; Read, Yuille & Tollestrup, 1992; Steele & Josephs, 1990). This is believed to be because intoxication limits encoding to only the most salient cues in the environment (Denson et al., 2008; Giancola & Corman, 2007; Mintzer, 2007; Read et al., 1992; Sayette, 1999; Soderland, Grady, Easdon, & Tulving, 2007; Steele & Josephs, 1990). Moreover, this has been found to be particularly evident in tasks that involve systematic, elaborate, and deliberate encoding strategies (Medina, 1970; Rosen & Lee, 1976).

Relatively little is known about how alcohol intoxication effects face recognition specifically. Read et al. (1992, Exp. 2) found that participants who committed a staged robbery while they were intoxicated (at a mean breath alcohol concentration of .08) showed poorer recognition one week later for both “intruders” and “bystanders” in target-present line-ups than participants who had been sober at the time of the robbery. In contrast, Yuille and Tollestrup (1990) tested participants who were intoxicated while they observed (rather than participated in) a staged theft. They found that intoxication (mean breath alcohol concentration of .10) at the time of watching the theft did not affect recognition accuracy one week later for the thief in target-present photo line-ups, but did result in higher false identifications in target-absent line-ups. Similarly, Dysart, Lindsay, MacDonald and Wicke (2002) compared a low-intoxication group (mean breath alcohol concentration of .02) to a high-intoxication group (mean breath alcohol concentration of .09) and found that, while these two groups did not differ in their accuracy rates in target-present show-ups, the high-intoxication group made more false identifications than the low-intoxication group in target-absent show-ups. Importantly, this study, which had participants attempt an identification while they were still intoxicated (12 minutes after interacting with the target), found the same pattern of results as Yuille and Tollestrup, who had participants intoxicated at the time of the event, but tested on their recognition accuracy when sober (one week later). Together, these three studies show that even moderate levels of alcohol intoxication reduce face recognition accuracy. Importantly, none of these studies systematically varied the race of the participants and/or the targets. This is a significant gap in our knowledge regarding the effects of alcohol intoxication on face recognition.

Investigating any differential effects of intoxication on same-race and different-race face recognition has both practical and theoretical implications. First, many crimes, particularly violent ones, occur when the victims and/or witnesses are intoxicated. A number of studies in both the US and Australia have found that a large proportion of assault victims (as well as perpetrators) were drinking alcohol prior to the assault (e.g. Pernanen, 1991; Poynton, Donnelly, Weatherburn, Fulde, & Scott, 2005; see also Boles & Miotto, 2003). In cases where victims (and witnesses) do not know the perpetrator, identification evidence becomes an important factor in any subsequent police investigation. However, without knowing whether alcohol intoxication affects both same-race and different-race faces equally, we do not know how detrimental it is to the prosecution’s case when a witness was intoxicated at the time they observed a same-race or different-race perpetrator and subsequently tried to identify that person in a line-up. Second, examining the effects of alcohol intoxication on the magnitude of the own-race bias may also help us better understand the mechanisms driving this bias, as explained below.

Theories of the ORB

It is clear that an important factor in the own-race bias is the lower level of contact most people have with different-race compared to same-race individuals (see McPherson, Smith-Lovin, & Cook, 2001; Meissner & Brigham, 2001). There is less agreement, however, regarding the mechanism by which contact levels modulate face recognition performance. Current models can be divided into two broad categories: perceptual-expertise models and social-categorization models.

Perceptual-expertise models of the own-race bias suggest that low levels of contact with different-race faces result in a lack of expertise in the perceptual encoding of these faces, and it is this poor encoding that leads to worse recognition of different-race faces compared to same-race faces (Chance & Goldstein, 1996; Goldstein & Chance, 1980; Lindsay et al., 1991; Meissner & Brigham, 2001; Walker & Hewstone, 2006). Some researchers suggest this lower level of perceptual expertise reveals itself primarily through a failure to encode the features of different-race faces which best individuate members of that group (e.g. Ellis, Deregowski, & Shepherd, 1975; Hills & Lewis, 2006; Valentine, 1991; Valentine & Endo, 1992), whereas others argue that different-race faces are encoded in a less configural and/or holistic manner compared to same-race faces. *Configural* encoding refers to encoding the spatial relationships between facial features, and *holistic* encoding refers to encoding the face as a single entity, rather than as a collection of features (see Maurer, Le Grand & Mondloch, 2002). Both these encoding strategies have been shown to lead to better recognition, and to be more evident in the encoding of same-race faces compared to different-race faces (e.g. Michel, Rossion, Han, Chung, & Caldara, 2006; Rhodes, Brake, Taylor, & Tan, 1989; Tanaka, Kiefer, & Bukach, 2004).

Regardless of the specifics, a core implication of these perceptual-expertise models of the own-race bias is that this bias arises because our greater contact with same-race faces leads to expert processing of these faces. Thus, with sufficient exposure to different-race faces, expertise in the recognition of these faces will also develop (see Hills & Lewis, 2006; Michel et al., 2006; Valentine 1991; Valentine & Endo, 1992). However, while some studies have shown that higher contact with different-race faces – either through experimental manipulations or real-world experience – is associated with a smaller own-race bias (e.g.

Chiroro & Valentine, 1995; Elliot, Wills, & Goldstein, 1973; Goldstein & Chance, 1985; Hancock & Rhodes, 2008; Malpass, Lavigueur, & Weldon, 1973; Sangrigoli, Pallier, Argenti, Ventureyra, & de Schonen, 2005), other studies have failed to find any significant association between contact levels with different-race people and different-race face recognition accuracy (e.g. Brigham & Barkowitz, 1978; Goodman et al., 2007; Ng & Lindsay, 1994). Moreover, most studies that included minority-race members found these participants also showed an own-race bias, suggesting that even a high level of contact with different-race people over a long period of time is insufficient to eliminate the effect (e.g. MacLin & Malpass, 2001; Ng & Lindsay, 1994; Rhodes et al., 1989; Walker & Hewstone, 2008; but see also Tanaka et al., 2004, and Walker & Hewstone, 2006).

Social-categorization models posit a different explanation for the own-race bias, focusing on processes of automatic categorization. A large body of social psychological research demonstrates that people think of and describe out-group members at the category level, and in-group members at the individual level (the out-group homogeneity effect; see Levin, 2000; Linville, Fischer, & Salovey, 1989). Accordingly, the social-categorization models of the own-race bias suggest that, because of reduced levels of contact with different-race faces, we have learned to categorize different-race individuals as out-group members, and thus to pay attention only to shared, group-level features when encoding their faces (Malpass, 1990; Rodin, 1987). As a result, members of the different-race group are poorly distinguished from each other in memory, and thus, subsequent recognition suffers (see Levin, 2000). In contrast, same-race people are categorized as in-group members and are therefore encoded with regard to their individuating features, facilitating later recognition (e.g., Hugenberg, Miller, & Claypool, 2007; Levin, 1996, 2000; MacLin & Malpass, 2001; Shriver, Young, Hugenberg, Bernstein, & Lanter, 2008; Sporer, 2001). This approach therefore conceptualizes the own-race bias as an example of an in-group/out-group categorization process, rather than a result of differential expertise in the encoding of faces from different racial groups. That is, it is not that people *cannot* encode different-race faces at a level which will support individuation, but rather, that people *do not* normally do so.

One problem in attempting to test these two explanations is that they often predict the same outcome, and the results of many studies can be explained using either a perceptual-expertise or a social-categorization framework (see Meissner & Brigham, 2001; Sporer, 2001; Hilliar & Kemp, 2008). Although we acknowledge that these models are not mutually exclusive, it is important to understand their relative importance in explaining the own-race bias. Examining the effects of alcohol intoxication on the own-race bias may help determine which of these processes plays a more important role in driving this bias, or at least help us to eliminate some variants of these explanations. We provide further elaboration in the Discussion section.

Study Aims

The primary focus of this study was to examine the potential practical implications of the influence of alcohol intoxication on the magnitude of the own-race bias. In addition, we hoped that the results might help clarify the relative importance of perceptual-expertise and social-categorization mechanisms in eliciting the own-race bias. To this end we tested Asian and European participants' recognition memory for Asian and European faces when they were either sober (Placebo condition) or at a low-to-moderate level of alcohol intoxication (Alcohol condition).

Method

Participants and Design

A total of 139 University of New South Wales (UNSW) students in Sydney, Australia completed the study in exchange for either course credit or AUD$20. All participants were at least 18 years old (i.e., of legal drinking age in Australia). The sample consisted of 71 Asian participants (40 females; age range = 18-41; M_{age} = 20.92 years; SD_{age} = 3.75) and 68 European participants (44 females; age range = 18-48; M_{age} = 20.40 years; SD_{age} = 4.05). The term "Asian" is used here to refer to Australian and exchange students who are exclusively of East/South-East Asian descent, while "European" is used to refer to Australian and exchange students who are exclusively of Western European descent. This study employed a 2 (Race of Participant: Asian or European) × (2) (Race of Face: Asian and European) × 2 (Alcohol Status: Alcohol or Placebo) mixed design, wherein Race of Participant and Alcohol Status were between-participant factors.

Materials

Alcohol Administration and Breath Alcohol Concentration Assessment. All participants were informed that they would be receiving alcohol. Participants in the Alcohol condition were given 2.42ml of vodka (37.5% alcohol) for every kilogram of lean body mass. This was divided between two cups and mixed with lemon-flavored tonic water. Participants in the Placebo condition were given two cups of lemon-flavored tonic water with vodka swabbed on the rim of the cup and several drops laid on top of the drink, to give the drinks the taste and smell of alcohol without affecting participants' breath alcohol concentration. In both the Alcohol and Placebo conditions, participants were given 5 minutes to drink each cup. Participants completed a breathalyser test using the Alco-Sensor IV (Intoximeters, Inc.) before they received any drinks, just after drinking, and just before and after they completed the face recognition task. To eliminate residual alcohol in the mouth, participants rinsed their mouths with water before each breathalyser test. Participants were not told their alcohol readings. They were given access to water throughout the experiment. As the ascending and descending limbs of the alcohol curve have been shown to have different effects on memory (Loke & Lai, 1993; Mintzer, 2007), the position on the alcohol curve in which participants completed the recognition task was counterbalanced. This was done by having participants do another unrelated experiment as well as our recognition task. Mixed analyses of variance tests confirmed that the order in which participants did these two tasks did not interact with any other variables (all *F*s < 2.68, all *p*s > .1).

Subjective Intoxication Measure. Thinking one is intoxicated sometimes influences task performance (see Hull & Bond, 1986; Nicholson, Wang, Airhihenbuwa, Mahoney & Maney, 1992; Nicholson, Wang & Mahoney, 1994), so participants' subjective feelings of intoxication were measured to see if this was related to face recognition accuracy. Subjective intoxication was measured at the start of the experiment (baseline measure), and just before and after completion of the face recognition task. Participants were asked to indicate how "intoxicated" they felt on an 11-point scale, where 0 = "not at all", and 10 = "extremely".

Face Recognition Task. There were two blocks to the computer-based recognition task. In Phase 1 (the study phase) of the first block, participants were shown color photographs of 10 faces (either all Asian or all European). All faces were of males aged in their early-twenties, holding a neutral expression, with no facial hair or other distinguishing features (e.g., facial piercings, tattoos, scars), and of a standardised height of 500 pixels (image width was allowed to vary to maintain aspect ratio). Each face was presented on the computer screen for three seconds followed by a one-second inter-stimulus interval. The faces selected to be shown in this study phase was randomly determined for each participant. Participants then completed a two minute mental arithmetic filler task before starting Phase 2 (the test phase) in which they were shown, one at a time, the 10 'old' faces from the study phase randomly mixed in with 10 'new' faces of the same race. Participants used the computer mouse to click on one of two buttons to indicate whether each face was 'old' or 'new'. Participants could examine each face for as long as they wanted before making their decision, and response times were recorded by the computer. The order in which the faces were shown in the study and test phases was randomly determined for each participant. The second block used the same procedure and began immediately after the first, but tested participants' recognition for the other face type (e.g. if they were tested on Asian faces in the first block, they were tested on European faces in the second block). The order of these two blocks (i.e. tested on Asian faces or European faces) was counterbalanced across participants, and this manipulation did not interact with any variables of interest. This 'blocked' method (where recognition for each group of faces is tested separately, rather than together) was adopted because it has been shown to increase the magnitude of the own-race bias (see Meissner & Brigham, 2001).

Contact Questionnaire. After they had completed both blocks of the recognition task, participants answered a series of questions regarding their level of contact with individuals of Asian and European descent (see Hancock & Rhodes, 2008). This questionnaire asked participants to list all the countries they had lived in for 6 months or more, and to indicate the degree to which they interacted with European and Asian individuals on a day-to-day basis using two 6-point scales (1 = "I see them around the community, but very rarely speak to them", 6 = "They compose my entire circle of friends").

Procedure

The experiment was advertised at UNSW as a study on "cognitive and social abilities". When participants first enquired about the experiment, they were told that the study involved the consumption of alcohol, that they would therefore not be able to drive for some time after the study, and that the experiment would take about 1.5 hrs to complete. If they were willing to participate, they were then taken through an initial screening that excluded anyone who was: younger than 18 (the legal drinking age in Australia); taking any medications for which alcohol was contraindicated; pregnant; not exclusively of East/South-East Asian or Western European descent (participants were not informed that their race was a variable of interest until the conclusion of the experiment); had already done a similar face recognition task; reported any cardiovascular problems or had a pacemaker; drank alcohol on less than one occasion per month; or scored higher than 10 on the Alcohol Use Disorders Identification Test (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). All eligible participants were then scheduled for an individual appointment at the university, and agreed to adhere to a pre-experimental protocol that included refraining from consuming alcohol or illicit drugs for 24 hr prior to their appointment, and from eating for 2 hr prior to their appointment.

Upon arrival to the laboratory, participants gave informed consent, indicated their current feelings of intoxication (all reported feeling “not at all” intoxicated), and were asked whether they had adhered to the pre-experimental protocol. No participants reported failure to comply with these instructions. In addition, female participants were required to take a hormonal pregnancy test prior to beverage administration. No positive test results occurred.

Participants then had their height and weight measured, and their percentage of body fat calculated with an electronic scale, before completing the MINI International Neuropsychiatric Interview (Lecrubier et al., 1997). Five participants were disqualified from participating due to giving responses that indicated a possible Axis I disorder (two for alcohol and drug dependency, one for bipolar disorder and depression, and two for anxiety), and were informed about counselling services on campus.

All eligible participants then gave their first breathalyser test (all returned a result of zero), and were randomly assigned to either the Alcohol condition (n = 71; 35 Asian participants; 47 females; M_{age} = 20.04 years; SD_{age} = 2.50) or Placebo condition (n = 68; 36 Asian participants; 37 females; M_{age} = 21.31 years; SD_{age} = 4.90). They were given 10 minutes to consume their two drinks and rinsed their mouth with water before undergoing the second breathalyser test and again rating their feelings of intoxication.

Before starting the recognition task, participants were given the following written instructions:

> In this study you will complete a face recognition task. There will be a number of blocks in this experiment. In each block there will be two Phases. In Phase 1 you will be shown a series of people's faces. You do not need to do anything except sit and absorb the information presented to you. In Phase 2 we will show you some more faces and you will have to decide whether each face was shown in Phase 1 (i.e. is an 'old' face), or not (i.e. is a 'new' face).

Participants then completed the two blocks of the face recognition task, as well as an unrelated task on social interactions, in counterbalanced order. If participants completed the recognition task second, they again indicated their feelings of intoxication and completed an additional breathalyser test immediately prior to the recognition task.

After the recognition task participants undertook another breathalyser test, indicated their feelings of intoxication, and completed the Contact Questionnaire. They were then debriefed, thanked for their time, and breathalysed again. Participants were only allowed to leave the laboratory when their breath alcohol concentration was less than .045.

Results

Intoxication Levels

In the Placebo condition, all participants recorded breath alcohol concentrations of zero throughout the experiment, and their self-ratings of intoxication at the time they did the face recognition task ranged from 0 to 7 (out of 10), with a mean rating of 1.44 (*SD* = 1.69). In the Alcohol condition, participants' breath alcohol concentrations just prior to completing the face recognition task ranged between .016 and .13, with a mean of .05 (*SD* = .02), which is a low-to-moderate level of intoxication (see Bartholow, Dickter, & Sestir, 2006). Participants in the Alcohol condition also gave subjective ratings of intoxication at the time of the face recognition task that ranged between 0 and 10, with a mean rating of 3.97 (*SD* =

2.41). Participants in the Alcohol condition thus reported feeling significantly more intoxicated than those in the Placebo condition (t(125.66) = 7.20, *95% CI for mean difference* = 1.83 to 3.23, p < .001, d = 1.28).[1] There were no differences in self-reported levels of alcohol consumption per month between the Alcohol and Placebo conditions (t(137) = .38, *95% CI for mean difference* = -5.58 to 8.25, p = .703, d = .06).

Although the Asian participants reported consuming significantly fewer standard alcoholic drinks per month (M = 10.85, SD = 11.02) than European participants (M = 25.54, SD = 25.1; t(91.07) = -4.44, *95% CI for mean difference* = -21.28 to -8.11, p < .001, d = .93, an independent samples t-test showed that in the Alcohol condition, the mean breath alcohol concentration for Asian (M = .05, SD = .02) and European participants (M = .05, SD = .02) were not significantly different (t(68) = .76, *95% CI for mean difference* = -.01 to .01, p = .449, d = .18). Moreover, Asian participants' subjective ratings of intoxication did not significantly differ from those given by the European participants in either the Alcohol condition (M = 3.97, SD = 2.44, and M = 3.97, SD = 2.41, respectively; t(69) = -.001, *95% CI for mean difference* = -1.15 to 1.15, p = .999, d < .001) or the Placebo condition (M = 1.33, SD = 1.77, and M = 1.56, SD = 1.61, respectively; t(66) = -.56, *95% CI for mean difference* = -1.05 to .59, p = .580, d = .14).

Overall Recognition Accuracy (A')

Face recognition accuracy was analysed by calculating each participant's *A'* score for Asian and for European faces. *A'* is a non-parametric signal detection measure of sensitivity – in this case the ability to discriminate 'old' from 'new' faces – that combines hit rates (correctly identifying 'old' faces as old) with false alarm rates (falsely identifying 'new' faces as old; see Stanislaw & Todorov, 1999).

The own-race bias can be observed in the presence of a significant interaction between the variables Race of Participant and Race of Face, when, in our case, Asian participants show better recognition for Asian faces than for European faces, and European participants show the opposite pattern. Indeed, a 2 (Race of Participant) × (2) (Race of Face) × 2 (Alcohol Status) mixed ANOVA found this two-way interaction to be significant ($F(1, 135) = 8.56$, $p = .004$, $\eta_p^2 = .060$), as well as a main effect of Alcohol Status ($F(1, 135) = 5.57$, $p = .020$, $\eta_p^2 = .040$), with participants in the Placebo condition (*M* = .84, *SD* = .07) showing better overall face recognition accuracy than participants in the Alcohol condition (*M* = .80, *SD* = .09).

The relationship between the magnitude of the own-race bias and level of intoxication was further investigated by conducting a separate 2 (Race of Participant) × (2) (Race of Face) mixed ANOVA for each Alcohol Status condition. These analyses revealed a significant Race of Participant × Race of Face interaction in the Placebo condition ($F(1, 66) = 9.96$, $p = .002$, $\eta_p^2 = .131$), but not in the Alcohol Condition ($F(1, 69) = 1.42$ $p = .238$, $\eta_p^2 = .020$). Thus, in the Placebo condition a conventional own-race bias was observed and paired-sample *t*-tests confirmed that Asian participants showed significantly better recognition memory for Asian faces compared to European faces, $t(35) = 2.34$, *95% CI for mean difference* = .01 to .08, $p = .025$, $d = .39$, whereas European participants showed significantly better recognition memory for European faces compared to Asian faces, $t(31) = 2.14$, *95% CI for mean difference* = .002 to .08, $p = .041$, $d = .38$ (see Figure 1). In contrast, there was only a non-significant trend indicative of an own-race bias in the Alcohol condition. Paired-samples *t*-tests showed that both Asian and European participants showed equivalent levels of recognition accuracy for Asian and European faces (both *t*s < 1.17, both *p*s > .245; see Figure 1). No other main effects or interactions were significant (all *F*s < 1.24, all *p*s > .268).

(Figure 1 about here)

As there were no significant main effects of Race of Participant or Race of Face in either the Placebo or Alcohol condition (all *F*s < .3, all *p*s > .6), we repeated the analysis collapsing across Asian and European participants. Paired-samples *t*-tests showed that in the Placebo condition, recognition accuracy was significantly higher for same-race faces (*M* = .86, *SD* = .07) compared to different-race faces (*M* = .81, *SD* = .10), *t*(67) = 3.19, *95% CI for mean difference* = .02 to .07, *p* = .002, *d* = .39. In the Alcohol condition, however, there was only a small tendency towards better recognition performance for same-race faces (*M* = .81, *SD* = .12) compared to different-race faces (*M* = .79, *SD* = .11), and this difference was not reliable, *t*(70) = 1.20, *95% CI for mean difference* = -.01 to .05, *p* = .233, *d* = .14 (see Figure 2). In addition, independent-samples *t*-tests revealed that recognition memory for same-race faces was significantly lower in the Alcohol condition (*M* = .81, *SD* = .12) compared to the Placebo condition (*M* = .86, *SD* = .07), *t*(111.49) = -2.75, *95% CI for mean difference* = -.08 to -.01, *p* = .007, *d* = .52. In contrast, recognition memory for different-race faces was only slightly, and non-significantly, lower in the Alcohol condition (*M* = .79, *SD* = .11) compared to the Placebo condition (*M* = .81, *SD* = .10), *t*(137) = 1.15, *95% CI for mean difference* = -.06 to .02, *p* = .252, *d* = .20. Thus, alcohol intoxication negatively affected same-race face recognition to a greater extent than different-race face recognition, which was poorer than same-race face recognition performance under sober conditions.

(Figure 2 about here)

Hit rates and False alarm rates

In addition to overall sensitivity (*A'*), it is important to separately examine participants' hit rates and false alarm rates as some research suggests the own-race bias is primarily driven by elevated false alarm rates for different-race faces compared to same-race faces, with hit rates for different-race and same-race faces being largely equivalent (see Meissner & Brigham, 2001). Separate analyses confirmed that the pattern of results observed in participants' *A'* scores was replicated in participants' false alarm rates, but not in their hit rates. As indicated in Table 1, both Asian and European participants showed higher false alarm rates (i.e. poorer recognition memory) for different-race faces compared to same-race faces in the Placebo condition, but not in the Alcohol condition. In contrast, participants' hit rates for same-race and different-race faces did not differ, both in the Placebo condition and in the Alcohol condition. Thus, participants' own-race bias in the Placebo condition was largely driven by a higher false alarm rate for different-race faces compared to same-race faces, with this superior performance for same-race faces being eliminated by alcohol intoxication.

Response biases (B")

Measures of response bias (such as the non-parametric measure of *B"*; see Stanislaw & Todorov, 1999) assess whether participants have a general tendency to respond to the task stimuli (in this case, the faces) in a particular way. In this study, a negative *B"* score implies a liberal response bias, or a tendency to judge most faces as 'old', whereas a positive *B"* score implies a conservative bias, or a tendency to judge faces as 'new'. Some studies have suggested that the own-race bias is due to a tendency for participants to apply a more liberal criterion to different-race faces compared to same-race faces, leading to higher false alarm rates for different-race faces (see Meissner & Brigham, 2001). Mixed ANOVAs on participants' *B"* scores, however, found no evidence of any response biases in participants' responding to same-race or different-race faces, in either the Placebo or the Alcohol condition (see Table 1). Participants' own-race bias in their *A'* scores was therefore not due to any biases in their response strategies.

Response times

Alcohol intoxication has been found to reduce response times across a variety of domains, from simple key presses (Kano et al., 2003; Krull, Smith, & Parsons, 1994; Schweizer, Jolicœur, Vogel-Sprott, & Dixon, 2004) to performing secondary tasks while driving (Allen et al., 2009). A 2 (Race of Participant) × (2) (Race of Face) × 2 (Alcohol Status) mixed ANOVA on participants' response times when judging same-race and different-race faces, however, found no significant main effects or interactions, including no main effect of Alcohol Status (all Fs < 1.34, all ps > .25; see Table 1). Thus participants' less accurate recognition memory in the Alcohol condition was not accompanied by slower responding. Nor was the own-race bias evident in the Placebo condition accompanied by slower responding to different-race faces. Details of these analyses, as well as those on participants' hit rates, false alarm rates, and response biases, can be obtained from the lead author.

(Table 1 about here)

The Relationship Between Recognition Performance and Objective and Subjective Intoxication

Separate multiple regression analyses confirmed that neither breath alcohol concentration nor subjective feelings of intoxication accounted for any significant proportion of the variance in participants' recognition accuracy for Asian or European faces on top of that already accounted for by Race of Participant and Alcohol Status (all ps > .05).

Recognition Performance and Contact Levels

As there were no differences in participants' self-reported same-race and different-race contact levels across the Alcohol and Placebo conditions (all ts < 1.55, all ps > .125), the following analyses on contact levels were collapsed across the two conditions. Both Asian and European participants reported having significantly more day-to-day contact with same-race people than with different-race people (Asian participants: $t(68) = 8.05$, *95% CI* = 1.71 to 1.03, $p < .001$, $d = .97$; European participants: $t(67) = 12.68$, *95% CI for mean difference* = 1.25 to 1.72, $p < .001$, $d = 1.54$). However, neither the Asian nor the European participants showed any significant correlations between same-race or different-race contact levels and same-race or different-race recognition accuracy (all *p*s > .250). Moreover, multiple regression analyses revealed that contact levels did not account for any significant proportion of the variance in participants' face recognition scores, in either the Alcohol or Placebo condition (all *p*s > .05).

Discussion

Overall, we found evidence for a significant own-race bias in participants' recognition memory for Asian and European faces in the placebo condition, but not in the alcohol condition. That is, sober participants showed better recognition memory for same-race faces than for different-race faces, but this advantage for same-race faces was greatly reduced when participants were intoxicated. Intoxication resulted in a significant reduction in recognition accuracy for same-race faces, but only a small, non-significant reduction in accuracy for different-race faces. This pattern of results was evident for both *A'* scores and false alarm rates, but not hit rates. Alcohol intoxication also did not affect participants' response biases or response times, which suggests its negative effects on face recognition accuracy is not simply due to a change in participants' response strategy or processing speed.

There was no association between recognition accuracy (for same-race or different-race faces) and breath alcohol concentration or subjective feelings of intoxication. This latter finding suggests that the effect of alcohol intoxication on face recognition is largely due to the pharmacological effects of the alcohol itself, rather than any alcohol-related expectancies.

Finally, we found no association between different-race face recognition and self-reported different-race contact levels. However, given that inter-racial contact accounts for only around 2% of the variance in the own-race bias (see the meta-analysis by Meissner and Brigham, 2001), our failure to observe any relationship between contact and recognition accuracy may be attributable to the quality of our indirect measure of inter-racial contact and associated lack of statistical power. A more elaborate measure that addresses the racial demographics of participants' past and present local communities and intimate friendship networks may be required if we are to observe any effects of inter-racial contact on recognition performance (see Bar-Haim, Ziv, Lamy, & Hodes, 2006; Meissner & Brigham, 2001; Sangrigoli et al., 2005).

Our results are consistent with those reported by Dysart et al. (2002) and Yuille and Tollestrup (1992), who similarly found that moderate levels of intoxication increased false alarm rates, but had no effects on hit rates. Thus, the same effects have been observed in studies where participants were either slightly intoxicated (mean breath alcohol concentration of .05) or moderately intoxicated (breath alcohol concentrations of approximately .10), tested on their face recognition memory while still intoxicated or when sober, and tested two minutes after exposure or up to one week later. This suggests that the effects of alcohol intoxication on face recognition accuracy are very stable, and robust to various manipulations such as degree of intoxication, state-at-test, and retention interval.

Theoretical Implications

Our finding that alcohol intoxication had a much stronger negative effect on same-race face recognition than on different-race face recognition suggests that alcohol intoxication is largely disrupting participants' usually expert perceptual processing of same-race faces, whereas participants' relatively poorer encoding of different-race faces is only slightly disrupted. These results therefore go some way in advancing our theoretical understanding of the own-race bias by providing some support for perceptual-expertise models of the own-race bias; specifically, that the basis of the own-race bias is the superior, expert processing of same-race faces compared to different-race faces, rather than any automatic categorization processes.

As explained earlier, alcohol intoxication is thought to impair memory through the restriction of attention at the time of encoding. According to perceptual-expertise accounts of the own-race bias, same-race faces are more expertly and elaborately encoded than different-race faces. We might therefore expect alcohol intoxication to have a larger negative effect on recognition accuracy for same-race faces compared to different-race faces, as the encoding of different-race faces is thought to emphasise characteristics of the group rather than individuating features (Rhodes et al., 1989; Valentine, 1991). According to this account, alcohol disrupts the expert encoding of same-race faces, but has little impact on the encoding of different-race faces because these faces are only ever encoded at a more general, group level.

In contrast, at least some versions of the social-categorization perspective would have predicted the opposite effect; that alcohol intoxication increases the magnitude of the own-race bias by impairing memory processes for different-race faces more than same-race faces. Cunningham, Milne, and Crawford (2007) found that both medium (mean breath alcohol concentration of .076) and high (mean breath alcohol concentration of .156) levels of alcohol intoxication disrupted participants' memory for stereotype-neutral information, while memory for stereotype-consistent information was unaffected. In another study, Bartholow et al. (2006) found that neural control mechanisms that enabled participants to successfully inhibit race stereotype-consistent responding were significantly impaired by a low dose of alcohol (mean breath alcohol concentration of .037). Thus, one effect of alcohol intoxication is to encourage reliance on racial stereotypes, thereby emphasising the "otherness" of different-race faces. From the perspective of social-categorization models of the own race effect, we might expect that such an effect of alcohol would further reduce the motivation to encode different-race faces, leading to even poorer encoding compared to sober conditions. Thus a social-categorization hypothesis might predict that intoxication should disrupt recognition memory for different-race faces more than for same-race faces, the opposite result to the one we observed.

However, we accept that other forms of the social-categorization models could account for our findings. For example, one could suggest that alcohol intoxication would reduce the magnitude of the own-race bias by lowering participants' motivation to encode *all types of faces* at the individual level, essentially prompting a 'lazy' encoding strategy. This lack of motivation may result in a restriction of attention when encoding same-race faces to only their most salient, group-level features, similar to the encoding process proposed for different-race faces. Although it is not possible to exclude this as a possibility, the absence of any effect of alcohol on decision latency suggests that the effect is not due to a very general motivational effect at least. Future studies however could more explicitly address the possible influence of these motivational factors.

Practical Implications

Although further study needs to be done to clarify the role of the perceptual-expertise and social-categorization mechanisms in the own-race bias, our current study clearly has implications for eyewitness identifications made by people who were intoxicated when they witnessed a crime. We suspect that many psychologists would have predicted that the effects of alcohol intoxication and the own-race bias would be additive; that is, while recognition memory for same-race faces would be impeded by alcohol intoxication, this negative effect would be even more pronounced when trying to identify different-race faces. Instead, our results suggest the somewhat surprising finding that different-race face recognition is, at worst, only very slightly less accurate when intoxicated than when sober. Instead, it is the recognition of same-race faces that is significantly impaired by alcohol intoxication, reducing performance to the level of accuracy seen for different-race faces. This suggests that identifications of same-race suspects made by intoxicated witnesses are likely to be as unreliable as identifications of different-race individuals made by sober witnesses.

While our results replicate findings observed in studies that tested participants when they were sober and with a line-up task, the fact that our participants were still intoxicated when asked to make their identification choices and tested using an old/new recognition paradigm, may limit the external validity of our findings. Although Dysart et al. (2002) argue that there is some forensic relevance in testing participants' face recognition accuracy while they are still intoxicated, it is the case that, more often than not, people are sober when making eyewitness identifications. Our study therefore needs to be replicated using participants who are sober at test before any clear advice can be offered to the legal profession, but we suggest that these preliminary results are sufficient to warrant caution when advising the courts about the likely effects of alcohol on the accuracy of same- and different-race identifications.

Study Limitations

Our study design also meant that our results do not clarify whether the own-race bias, and the detriment in same-race recognition accuracy when intoxicated, results from disruption to face encoding at the study phase, as we suspect, or due to impaired retrieval or mental matching at the test phase. However, research suggests that the own-race bias is largely attributable to difficulties in the initial *encoding* of unfamiliar faces (e.g. Furl, Phillips & O'Toole, 2002; Golby, Gabrieli, Chiao & Eberhardt, 2001; Megreya & Burton, 2008), and that alcohol intoxication more negatively affects encoding than retrieval processes (see Mintzer, 2007; Read et al., 1992). In light of this it seems likely that the locus of the interaction we have observed between these effects is also at the encoding stage. Ultimately, this issue is best resolved by a study in which participants learn a set of faces while sober or intoxicated and are subsequently tested when either intoxicated or sober. This orthogonal manipulation of sobriety and intoxication at time of study/encoding and test/retrieval would also identify the role of any state-dependent memory effects (i.e. that information learned in one state is better remembered when in that same state compared to a different state; see Kelemen & Creeley, 2003; Miles & Hardman, 1998), as opposed to intoxication effects. Moreover, giving participants a simple face matching task (e.g. that used in Megreya & Burton, 2008) when they are intoxicated or sober, would also help clarify the mechanisms driving the negative effects of alcohol intoxication on face recognition accuracy.

Although participants were, overall, performing at lower accuracy rates for different-race faces compared to same-race faces, and in the alcohol condition compared to the placebo condition, it was the case that recognition performance across the experimental conditions was never lower than 75%. We acknowledge that our recognition task could have been more difficult (e.g. by exposing participants to more faces, showing faces for a shorter duration, distracting participants during the encoding stage, or utilizing a longer retention interval; see MacLin, MacLin & Malpass, 2001; Meissner & Brigham, 2001; Meissner, Brigham & Butz, 2005; Memon, Hope & Bull, 2003), and this might have further accentuated any differences in recognition performance seen between the placebo and alcohol conditions (e.g. Schlauch, Lang, Plant, Christensen, & Donohue, 2009). However, the fact that we did find significant differences using only a simple recognition task and low levels of alcohol intoxication indicates the stability and robustness of the own-race bias and the negative effects of alcohol intoxication on face recognition.

Conclusion

Our findings contribute to the eyewitness identification literature by highlighting the importance of investigating how alcohol can influence the own-race bias. Our results suggest that the own-race bias has a significant impact on recognition performance only when the witness is sober. When intoxicated, same-race recognition accuracy drops to a level comparable to that of different-race faces. This has important implications when considering the reliability of same-race and different-race eyewitness identifications made by intoxicated witnesses. Finally, this study emphasizes the need for an increased understanding of the causes of the own-race bias, both so that we can better predict its impact on performance and so that we can reduce these effects.

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Footnotes

1. An alternative t-test was used when the homogeneity of variance assumption (*Levene's F*) was violated (p < .05). The effect size estimates we report are Cohen's (1988) *d* for between-group tests, and Becker's (1988) standardized mean gain (*d*) statistic for within-group tests (see Lipsey and Wilson, 2001).

Table 1

Table 1. Means (and standard deviations) for participants' recognition performance for same-race (SR) and different-race (DR) faces as a function of Alcohol Status (Placebo or Alcohol; mean breath alcohol concentration, or BAC, given in parentheses). Figures are given for False alrm rates (FR), Hit Rates (H), Criteria (B"), and Response Time (RT, measured in ms).

	SR-FA	DR-FA	SR-H	DR-H	SR-*B"*	DR-*B"*	SR-RT	DR-RT
Placebo (M BAC = 0)								
Asian participants	.24 (.16)	.30 (.18) #	.79 (.17)	.76 (.14)	-.07 (.41)	-.02 (.29)	1864.42 (572.20)	1977.20 (855.57)
European participants	.24 (.12)	.33 (.18) *	.80 (.10)	.80 (.15)	-.06 (.37)	-.15 (.34)	1857.94 (441.50)	1972.02 (586.72)
Alcohol (M BAC = .05)								
Asian participants	.31 (.16)	.30 (.19)	.76 (.15)	.73 (.15)	-.11 (.34)	.01 (.30)	1730.59 (420.15)	1828.02 (532.85)
European participants	.26 (.16)	.32 (.17)	.75 (.19)	.74 (.15)	-.05 (.39)	-.05 (.33)	1935.29 (624.15)	2014.57 (521.58)

Note: * = difference between mean score on same-race faces and mean score on different-race faces is significant at the $p < .05$ level, indicating an ORB; # = difference between same-race and different-race scores is significant at the $p < .08$ level.

Figure Captions

Figure 1. Recognition of Asian and European faces by Asian and European participants as a function of alcohol and placebo, as measured by *A'*. Error bars indicate +/- one standard error. An own-race bias is present when participants show significantly higher recognition accuracy for the faces from their own racial group compared to the faces from a different racial group.

ALCOHOL INTOXICATION REDUCES THE OWN-RACE BIAS

Figure 1

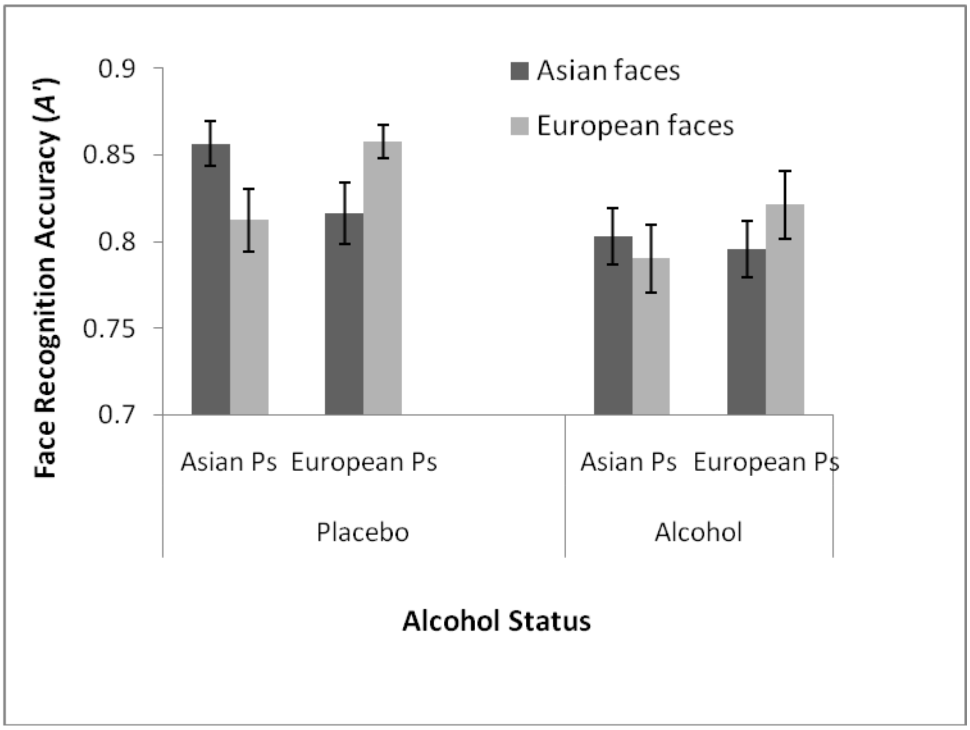

Figure 1. Recognition of Asian and European faces by Asian and European participants as a function of alcohol and placebo, as measured by *A'*. Error bars indicate +/- one standard error. An own-race bias is present when participants show significantly higher recognition accuracy for the faces from their own racial group compared to the faces from a different racial group.

Figure 2. Recognition of same-race and different-race faces as a function of alcohol and placebo, collapsed across Asian and European participants, as measured by *A'*. Error bars indicate +/- one SE. An own-race bias is present when recognition accuracy for same-race faces is significantly higher than that for different-race faces.

ALCOHOL INTOXICATION REDUCES THE OWN-RACE BIAS

Figure 2

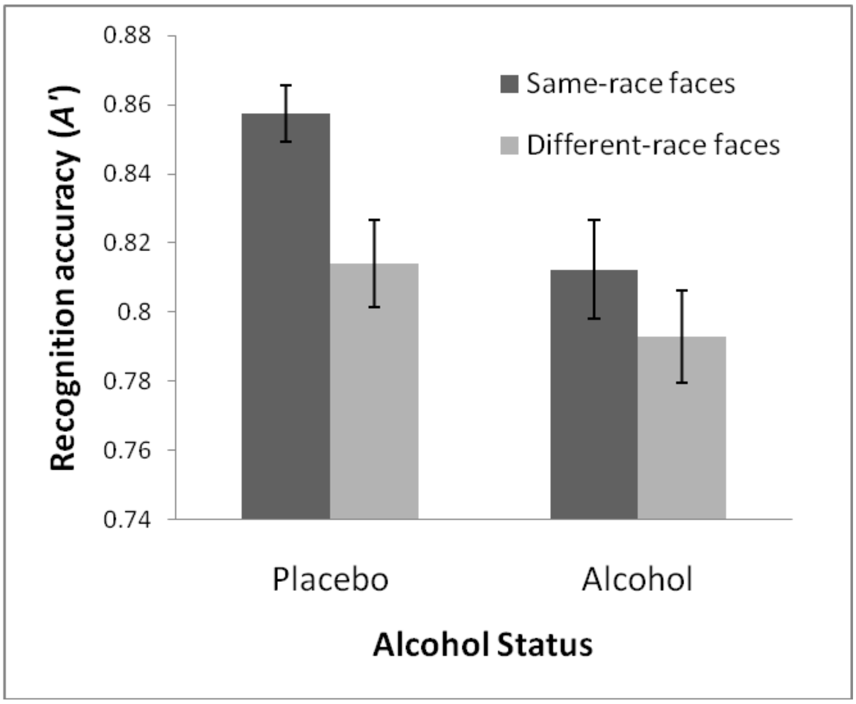

Figure 2. Recognition of same-race and different-race faces as a function of alcohol and placebo, collapsed across Asian and European participants, as measured by *A'*. Error bars indicate +/- one SE. An own-race bias is present when recognition accuracy for same-race faces is significantly higher than that for different-race faces.